

USING THE BELL PROVER TO CALIBRATE FLOW CALIBRATORS

Purpose This Meteorology and Air Quality Group (MAQ) procedure describes the use of the bell prover apparatus to calibrate the flow calibrators used to measure filter sample flow on AIRNET stations.

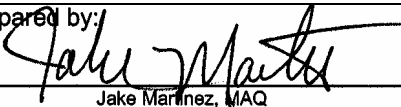



Scope This procedure applies to the AIRNET personnel who are assigned to calibrate the flow calibrators used to measure filter sample flow on AIRNET stations.

In this procedure This procedure addresses the following major topics:

Topic	See Page
General Information About This Procedure	2
Who Requires Training to This Procedure?	2
Using the Bell Prover Apparatus	4
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Hazard Control Plan The hazard evaluation associated with this work is documented in Attachment 1: Initial risk = **low**. Residual risk = **minimal**. Work permits required: none. First authorization review date is one year from group leader signature below; subsequent authorizations are on file in group office.

Signatures

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Work authorized by:  Jean Dewart, MAQ Group Leader	Date: <u>7/8/03</u>

06/16/03

CONTROLLED DOCUMENT

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Users are responsible for ensuring they work to the latest approved revision.

General information about this procedure

Attachments This procedure has the following attachments:

Number	Attachment Title	No. of pages
1	Hazard Control Plan	2
2	Set up of Bell Prover Apparatus and Pump	1

History of revision This table lists the revision history and effective dates of this procedure.

Revision	Date	Description Of Changes
0	8/13/03	New document.

Who requires training to this procedure? The following personnel require training before implementing this procedure:

- AIRNET personnel assigned to calibrate flow calibrators

Training method The training method for this procedure is **on-the-job** training by a previously-trained individual and is documented in accordance with the procedure for training (MAQ-024).

Prerequisites In addition to training to this procedure, the following training is also required prior to performing this procedure:

- MAQ-011, "Logbook Use and Control"
- First Aid
- Cardiopulmonary Resuscitation (CPR)

General information, continued

**Definitions
specific to this
procedure**

None.

References

The following documents are referenced in this procedure:

- MAQ-024, “Personnel Training”

Note

Actions specified within this procedure, unless preceded with “should” or “may,” are to be considered mandatory guidance (i.e., “shall”).

Using the bell prover apparatus

Background	<p>The calibrators used to measure and set the flow through the AIRNET filters were formerly calibrated by the manufacturer. Questions were raised about the calibration corrections used to correct for actual flow at the altitude of Los Alamos, and some inconsistencies were observed between instruments. The bell prover device provides a physical measurement for actual volume at the same altitude as the samplers and is thus a more accurate process to assure calibration of the flow measuring instruments.</p>
Description	<p>A large open-bottom drum of known dimensions is suspended in a ring of mineral oil (which provides an airtight seal around the edges) over an outlet pipe. As the drum falls a known distance (via scale on side), a known volume of air is displaced out the outlet pipe.</p>
Safety considerations	<p>The bell prover apparatus sits inside a large catch can that serves as secondary containment for any oil leaking out. The apparatus holds about 20 to 25 gallons of oil. An MSDS for the oil is located near the apparatus (MSDS #7292. NFPA Health rating: 0. Flammability: 1. Reactivity: 0).</p> <p>The apparatus has no significant hazards associated with it. Use common sense to avoid pinches, etc.</p>
When not in use	<p>Leave bell in raised position (between 0.5 and 1 on scale) when not in use. It must be kept in raised position at least 24 hours before use to allow air in the bell to equilibrate with room temperature.</p>
Equipment needed	<p>Set up equipment as shown in Attachment 2.</p> <p>In addition to the equipment set up, the following is needed:</p> <ul style="list-style-type: none">• Calculator• Stopwatch• Logbook to record data

Using the bell prover apparatus, continued

Raising the bell

Before each run, raise the bell to a position on the scale reading about 0.5: While holding the handle on the chain, open the rotary valve (on left in picture in Attachment 2) and pull down on the chain.

NOTE: Bell has slight damage on bottom edge that prevents accurate readings below about 0.5 on the scale.

WARNING

Do not let the bell fall to its lowest level when the pump is running – oil can be sucked into the lower inner chamber and eventually up the piping into the pump.

Steps to measure flow

To measure the flow with the bell prover, perform the following steps:

Step	Action
1	Hook up hoses, calibrator, and pump as shown in first picture in Attachment 2.
2	Remove hose from calibrator intake.
3	Close bypass valve (on right in second picture in Attachment 2).
4	Turn on pump and set the valve between calibrator and pump (red handle in first picture in Attachment 2) to desired flow rate as read on calibrator scale.
5	Turn off pump.
6	Reconnect hose from bell prover to calibrator intake.
7	Open bypass valve (on right in second picture in Attachment 2) and start vacuum pump.
8	Start stopwatch when scale on bell prover reads 1.0 or 2.0 cubic feet.
9	Stop stopwatch when scale reads 4.0 or 5.0 cubic feet.
10	WARNING: Turn off pump before bell falls all the way to bottom.
11	Calculate the flow rate: $\text{Flow (CFM)} = \text{volume (CF)} / \text{time (sec)} \times 60 \text{ (sec/min)}$
12	Mark the scale on the calibrator for the calculated flow rate.
13	Raise the bell (see block at top of page) and repeat the process (steps 2 – 12) for a different flow rate: <ul style="list-style-type: none"> Use 0.2 CFM increments between 2.0 to 5.0 CFM. Use 0.5 CFM increments between 0 to 2.0 and 5.0 to 6.0 CFM.
14	Record the readings and all calculations in a logbook. Note the identification numbers of the calibrators. Make entries in accordance with procedure MAQ-011.

Records resulting from this procedure

Records

The following records generated as a result of this procedure are to be submitted **within 3 weeks** as records to the records coordinator:

- Entries in logbook (made in accordance with MAQ-011)
- Copies of logbook pages showing calibration calculations

HAZARD CONTROL PLAN

1. The work to be performed is described in this procedure.

“Using the Bell Prover to Calibrate Flow Calibrators”

2. Describe potential hazards associated with the work (use continuation page if needed).

Oil in bell prover apparatus – spills could create slip hazards or health hazard.
Abrasions, bruises, or pinches from moving and handling equipment.

3. For each hazard, list the likelihood and severity, and the resulting initial risk level (before any work controls are applied, as determined according to LIR300-00-01, section 7.2)

Oil in bell prover apparatus – improbable / moderate = minimal
Abrasions, bruises, or pinches from moving and handling equipment – occasional / moderate = low

Overall *initial* risk: ☐ Minimal ☒ Low ☐ Medium ☐ High

4. Applicable Laboratory, facility, or activity operational requirements directly related to the work:

☒ None ☐ List: Work Permits required? ☒ No ☐ List:

HAZARD CONTROL PLAN, continued

5. Describe how the hazards listed above will be mitigated (e.g., safety equipment, administrative controls, etc.):

Oil in bell prover apparatus – catch pan as secondary containment is in place under the apparatus. An MSDS for the oil is located in the room (MSDS #7292. NFPA Health rating: 0. Flammability: 1. Reactivity: 0). Fire extinguisher is located in the room.

Abrasions, bruises, or pinches from moving pumps and materials -- Use common sense to avoid these injuries; also covered under Employee Orientation training.

6. Knowledge, skills, abilities, and training necessary to safely perform this work (check one or both):



Group-level orientation (per MAQ-032) and training to this procedure.



Other → See training prerequisites on procedure page 3. Any additional describe here:

7. Any wastes and/or residual materials? (check one) ☒ None ☐ List:

8. Considering the administrative and engineering controls to be used, the *residual* risk level (as determined according to LIR300-00-01, section 7.3.3) is (check one):



Minimal



Low



Medium (requires approval by Division Director)

9. Emergency actions to take in event of control failures or abnormal operation (check one):



None



List:

For all injuries, provide first aid and see that injured person is taken to Occupation Medicine (only if immediate medical attention is not required) or the hospital.

Signature of preparer of this HCP: This HCP was prepared by a knowledgeable individual and reviewed in accordance with requirements in LIR 300-00-01 and LIR 300-00-02.

Preparer(s) signature(s)

Name(s) (print)

/Position

Date

Signature by group leader on procedure title page signifies authorization to perform work for personnel properly trained to this procedure. This authorization will be renewed annually and documented in MAQ records.

Controlled copies are considered authorized. Work will be performed to controlled copies only. This plan and procedure will be revised according to MAQ-022 and distributed according to MAQ-030.

ATTACHMENT 2

SET UP OF BELL PROVER APPARATUS AND PUMP



Connection of hoses from bell prover to pump.



Valves on Bell Prover. Open relief valve on left to raise bell. Use wrench on bypass valve on right.